



leti

Avalanche photodiodes



Toward ultimate detection of small numbers of photons with no information loss

What it is

CEA-Leti's avalanche photodiodes enable high-sensitivity time-resolved detection in the infrared spectral bands.

A signal amplification gain of 1,000 can be obtained without added noise, thanks to a mercury cadmium telluride (HgCdTe) semiconductor absorption layer and a unique amplification process. The technology, which is effective even at room temperature, can be integrated into a range of detection systems, enabling new capabilities and enhanced performance.

What it can do

This technology, currently being transferred for production, is ideal for low SWaP-C (size, weight, power, and cost) detection products for industrial, and military applications:

- Free-space optical communications for secure, ultra-high-speed data transmission
- LiDAR for industrial detection, topographic imaging, defense, space, and mobility
- Time-resolved infrared detection for science (biomedical research, materials science, etc.)
- Quantum optics

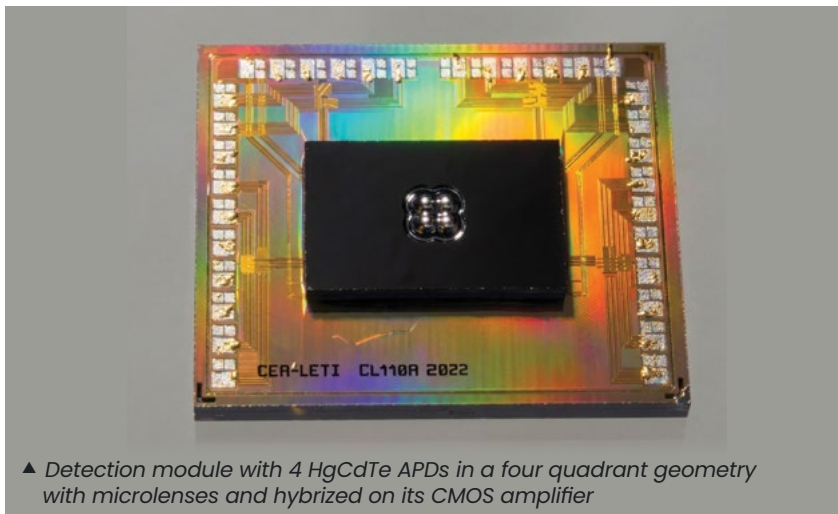
This project has received funding from the European Union (H2020), supported by French public authorities (France 2030), ESA and, CNES.



What makes it unique

CEA-Leti's avalanche photodiodes make detection systems simpler and enable new detection capabilities:

- Noise-free signal amplification (with a gain of 1,000) for the detection of weak signals normally drowned out by noise from nearby electronics, enabling single-photon detection in the short- and mid-infrared spectral bands.
- Monolithic microlens integration for an improved active optical surface that meets free-space optical coupling requirements.
- Hybrid amplifier integration for noise reduction, performance characterizable on-chip, and robustness against electromagnetic interference.



▲ Detection module with 4 HgCdTe APDs in a four quadrant geometry with microlenses and hybridized on its CMOS amplifier

Working with CEA-Leti

Manufacturers and integrators of quantum optics, LiDAR, and optical communications systems seeking unparalleled SWaP-C, and research laboratories looking for new detection capabilities can work with CEA-Leti to develop this technology for their needs.

This technology, which is ready for the market for the short-infrared band, can be developed in partnership with CEA-Leti for other spectral bands and for specific use cases. CEA-Leti supports new developments based on this technology, which can then be transferred for manufacturing of the finished component in partnership with startup Moon Photonics.

CEA-Leti, technology research institute

17 avenue des Martyrs, 38054 Grenoble Cedex 9, France
cea-leti.com

in  @CEA-Leti

Technology transfer

CEA-Leti spinoff Moon Photonics, founded in January 2026 to commercialize this cutting-edge technology for single-photon detection, is already commercializing a solution for the short-infrared band.

Scientific publications

- Rothman, J., et al. (2025). *Meso-photonics Detection with HgCdTe APDs at High Count Rates*. J. Electron. Mater. 49, 6881–6892.
- Rothman, J., et al. (2020). *High Operating Temperature Performance Characterization of SWIR HgCdTe Avalanche Photodiodes*. J. Electron. Mater. 54, 8323–8334.

Interested in this technology?

Contact:

Nicolas Lio Soon Shun

nicolas.liosoonshun@cea.fr

+33 679 295 297